

## Vestibular Rehabilitation: An Efficient Way in Therapy of balance disorders

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The Vestibular system is responsible for discovering body movements as a result of linear excitations or angular acceleration entering the head at all levels. After completing the vestibular information through other balance organs the followings are achieved:

1) Keeping visual target on the fovea, for high-frequency stimulus, for example, walking and running (above 2KHZ).

2) Keeping balance

The role of the vestibular system is a warning of the brain about head position and it is considered as an internal reference in keeping balance. There are two other systems, visual and proprioceptive systems, as external references that aware the brain of environment movements and equilibrium. The coordinated action and integration of these sensory systems together cause natural balance.

If there is a difference between internal and external references, imbalance or illusion of motion occurs. Therefore, to eliminate the illusion either the brain must adapt with these uncoordinated signals or other systems must be replaced with impaired system. The process takes place by doing exercises that named vestibular rehabilitation.

Unfortunately most experts believe that vestibular rehabilitation is only for benign paroxysmal positional vertigo (BPPV) diseases and include trainings that are related to BPPV. The treatment idea of vestibular disorders by coordinated eye, head and body exercises is for 50 years ago. In the mid-40s of the 20<sup>th</sup> century an ear nose and throat specialist (Cawthorne) observed that some patients with

vertigo are improved quickly by doing fast head movements (1). Even now, decades passed since then, balance exercises have developed and can be used for a wide spectrum of these patients.

There are three main patterns to create vestibular exercises:

### 1) Adaptation

Central vestibular system and brain will learn to be adapted with uncoordinated signals from damaged environmental vestibular sensory receptors. Vestibular ocular Reflex (VOR) stabilizes images on the retina during the head movements by producing eye movements in the opposite direction. If both sides of the vestibular systems act uncoordinatedly, VOR will be highly under the influence (2).

Improvement of VOR and elimination of retinal slip is the target of gaze stabilization exercises. For example, there is no way while one of the propeller aircraft work shall the other, unless amplification the other propeller increases by a computer board program. Furthermore this is exactly what adaptation exercises perform to increase VOR efficiency on the affected vestibular system.

### 2) Substitution

When one or more sensory system are damaged, another system can substitute it, for example, someone who has hearing problems, his visual system will be employed more efficiently.

So a person, who has lost his vestibular system performance, can rely on the other balance sensor receptors like vestibulo-spinal, cervical-

spinal and visual inputs. Exercises fulfill this intention called adaptation exercises.

### 3) BPPV exercises

There are different methods for rehabilitation of benign paroxysmal positional vertigo (BPPV). In these methods, otoliths particles that exit from utricle and floating in semicircular canals are returned to utricle by doing one or more positioning maneuvers.

Vestibular system disorders are divided into several categories:

These categories are the result of the vestibular system disorders diagnostic tests like HIT/VEMP/ECochG/VNG and etc. Each of the above vestibular exercises is useful for specific balance disorders that some of them are mentioned below:

- Unilateral vestibular disorders without instability:

The main symptom is vertigo caused by head movements and sometimes just dizziness due to the fast head movements on one side. The category balance exercises include adaptation exercises in order to modify VOR.

- Unilateral vestibular disorders with instability :

These patients feel insecurity in addition to the above symptoms while walking specially in dark or uneven surfaces. The category balance exercises include adaptation and substitution exercises.

- High frequency vestibular disorders :

These disorders may not be recognized in VNG test because it evaluates low frequency movements, whereas these patients have balance disorders with fast head movements. The category balance exercises include adaptation strategy based on the VOR modification.

- Bilateral peripheral vestibular disorders:

These patients feel instability and imbalance and substitution balance exercises can improve person's balance function to some extent.

- Central vestibular disorders :

These disorders can be recognized by VNG test. The category main exercises are also substitution exercises.

- Benign paroxysmal positional vertigo (BPPV):

The disorder is recognized by Hallpike maneuver and many therapy exercises are mentioned for it (3).

According to the mentioned subjects, various balance exercises can be designed and implemented, something that requires no medication, increase patient ability to keep balance and reduce vestibular system problem symptoms.

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